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*A new turn in*  
**SCRAPIE  
ERADICATION**

ARS 22-94

September 1965

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Agricultural Research Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

## ABOUT THIS REPORT . . .

Scrapie, a strange and puzzling disease of sheep, was first reported in this country over 18 years ago, but has been established for over 200 years in certain areas of Europe.

The European countries are attempting to "live with the disease," which is present in a substantial percentage of their flocks. In the United States, where scrapie is present in a very small number of flocks, we have a program to eradicate the disease.

Since this effort began 13 years ago, the number of flocks under surveillance for the disease has declined about two-thirds.

Evidence has been accumulating that the disease is caused by a transmissible agent and is contagious. However, research and experience have strengthened the conviction that genetics plays a great part in susceptibility or resistance to the disease, as it does in other diseases.

The scrapie program is therefore continuing to eliminate affected sheep but was recently modified to provide increased attention to close relatives of the diseased sheep. This and other modifications should strengthen the eradication effort and, at the same time, lessen the inconvenience to sheepmen.

This report explains the modifications being made and some of the findings that prompted the change.

Information for this report was provided by the Animal Health Division and the Animal Disease and Parasite Research Division of the Agricultural Research Service.

## A NEW TURN IN SCRAPIE ERADICATION

The State-Federal program for eradication of scrapie, an insidious disease of sheep and goats, has been modified to make the campaign more practical and effective.

Based on experience and new research information, a limited number of animals that would not have been covered by the program are now specifically included and will be slaughtered to safeguard against future outbreaks. These are close relatives of the affected animals. These relatives, comprising the affected bloodline, are believed to be genetically susceptible and likely to come down with scrapie.

On the other hand, many animals that would have been subject to slaughter under earlier provisions of the program now may be saved. That should reduce mandatory slaughter by about 50 percent.

Since scrapie eradication was undertaken in 1952, notable progress has been made toward reducing the number of sheep exposed to the disease. There has been a decline in the number of exposed flocks from a maximum of 2,035 in 1956 to 786 flocks in 1964. The innovations now being introduced into the program should accelerate eradication.

Before the modifications were put into effect, they were adopted by the United States Livestock Sanitary Association and by sheep and goat industry groups.

## SCRAPIE IS AN INFECTIOUS DISEASE

Scrapie is an infectious nerve disease of sheep and goats causing a sensation of itching. Animals literally scrape off their wool and even some skin, lose coordination, become prostrate, and die.

A few such symptoms are indicative, but true diagnosis depends on microscopic examination for vacuoles (tiny cavities) in certain cells of the brain and upper spinal cord.

The disease is slow to incubate, commonly taking from 18 to 42 months or longer for signs to show up in an animal after its exposure to sources of infection.

Most animals do not show signs of the disease until 2½ to 4 years of age, although a few animals as young as 18 months and a few as old as 10 years have become affected.

After first signs of scrapie appear, the symptoms generally increase, though they may temporarily subside. The disease usually runs its course in 6 weeks to 6 months. Unusual cases may take as little as 3 weeks or as long as a year. So far as is known, all affected animals ultimately die of the disease.

The causative agent has not been identified, although there is every reason to believe that scrapie is an infectious disease, probably caused by a virus. The disease has been artificially transmitted by tissue from an affected animal to an unaffected one. It has been transmitted not only between animals of the same species, but also to and between different species—sheep, goats, mice, rats, and hamsters.

While goats are susceptible to scrapie, no natural occurrences of scrapie in goats have been reported in this country.

Scrapie usually spreads naturally from infected flocks of sheep to healthy ones through the sale or loan of breeding animals, and then spreads among animals in the recipient flock. The disease also has been transmitted unintentionally by vaccine produced from brain and spinal cord material from lambs raised on scrapie-contaminated pastures.

The manner in which scrapie spreads between animals has not been fully explained. Most disease-control officials feel that both exposure and heredity are involved. An animal inherits either resistance or susceptibility to scrapie, but the susceptible ones will not get the disease unless exposed to the causative agent.

Thus, there is strong evidence of the infectious nature of scrapie. However, no one has been able to develop a test for diagnosing scrapie in the live animal, and we still have no vaccine or other preventive, and no cure for the disease.

## HEREDITY IS A FACTOR

Research workers and disease-control officials have noticed a high incidence of scrapie among sheep of certain bloodlines. This seems too striking to be coincidental.

Scrapie is primarily a problem with purebred sheep because grade animals, particularly lambs going to slaughter, usually are not kept long enough for this slow-developing disease to show up. The disease has occurred naturally in just three breeds in this country but in most of the breeds in Great Britain.

Since 1947, scrapie has been diagnosed in 27 States in 233 Suffolk sheep, 12 Cheviots, and 1 Hampshire. It is believed, however, that sheep of every breed in this country may be susceptible.

W. S. Gordon, Director of the Agricultural Research Council Field Station, Compton, England, inoculated sheep of 24 breeds with preparations of infected tissue. None of the 48 sheep of one breed developed the disease, although scrapie has been known in this breed. Seventy-eight percent of the sheep of another breed inoculated came down with the disease. The incidence in the other breeds varied between these two rates.

Gordon also gave infected brain and nerve tissue by mouth to 50 other sheep, and 8 of them developed scrapie. The parents of all 50 were also given the tissue. Parents of the 42 scrapie-free animals did not react, but one or both parents of the 8 susceptible animals were also susceptible.

How sheep transmit scrapie to their progeny has not been fully explained, but disease-control officials have noticed the following relationships in observations made on infected premises:

- When both parents developed scrapie, the offspring almost always developed the disease.
- When the dam but not the sire developed scrapie, about 67 percent of the offspring developed the disease.
- When the sire but not the dam developed scrapie, about 35 percent of the offspring developed scrapie.

Affected dams and unaffected sires beget more diseased offspring than unaffected dams and affected sires. The fact that lambs are associated more intimately with their dams than with their sires, increases the chance of contact transmission from the dam. Research workers have also reported that the progeny of scrapie-free dams and scrapie-free sires may develop the disease if reared on contaminated premises. The percentage of those doing so, varied from 8 to 57 percent.



Disease-control officials in this country have observed that when scrapie develops in half brothers and half sisters, they are often by the same sire. Similar observations have been recorded from other countries. A purebred Suffolk ram imported from England to Canada and bred to unaffected ewes there, sired at least 18 offspring which developed scrapie. The sire reportedly died of causes other than scrapie.

## **HOW THE PROGRAM OPERATES**

The campaign for eradication of scrapie in the United States is adapted from methods long used for stamping out other infectious diseases.

This campaign provides for slaughtering and making indemnity payments for affected sheep and goats and their close relatives and for close surveillance and sometimes slaughter of animals that may have been exposed to the disease. Success of the operation depends on prompt reporting of suspicious cases, field diagnosis confirmed by laboratory studies, slaughter and burning or burying of the affected animals, and the payment of indemnities for all animals slaughtered.

ARS disease-control officials work closely with the sheep and goat industry, breed organizations, State livestock sanitary officials, research workers, and consultants. Study groups are also held from time to time to review and evaluate progress and to give research scientists an opportunity to present their latest findings on scrapie.

### **Affected Animals**

State or Federal veterinarians examine any suspect sheep and all members of its flock. They often move the suspect sheep to a laboratory for observation. After the animal dies, tissues are sent to a State or Federal laboratory for study. Both the animal's symptoms and the laboratory's findings from the tissue are considered in making a diagnosis and determining what is to be done with related and associated sheep. From the beginning, the program has required that all animals diagnosed as having scrapie be slaughtered and their carcasses burned or buried under supervision of disease-control officials. This removes a known source of infection and is essential in eradicating any communicable disease. These provisions remain unchanged.

### **Affected Bloodlines**

In the original program, the close relatives of an affected animal (parents, full and half brothers and sisters, and progeny) were often slaughtered as members of the infected flock or the source flock. If they had been out of contact with the affected sheep or had never been in direct contact with it, they were spared. Under the revised procedures, animals of the affected bloodline are slaughtered regardless of where they are or whether they have been associated with the affected sheep. This should expedite eradication.

### **Infected Flocks**

Heretofore, all animals in a flock in which scrapie had been diagnosed were slaughtered. Now it makes a difference whether scrapie is sporadic or entrenched in the flock. In any event, the affected animal and its bloodline (sire and dam, its full and half brothers and sisters, and its progeny, including grand and great-grand offspring) must, of course, be slaughtered.

Now, disease-control officials study each infected flock, considering, among other facts, the history of the flock, how replacements are purchased, the number of affected animals, their bloodlines, and whether the affected animals were born in the flock or when they were brought into it. If the study shows that scrapie is entrenched—that the flock not only has scrapie but it is spreading it—the entire flock must be slaughtered.

If, on the other hand, the study shows that the outbreak is merely sporadic and limited to certain close relatives, the program revisions may make it possible to offer the owner the choice of keeping most of his flock under quarantine. This choice can be offered only if the flock management, pedigree records, and other records are adequate for accurate identification of all flock members, and the location and terrain of the affected premises are adequate for effective quarantining.

To save any part of the flock, the owner must agree to cooperate in a quarantine involving monthly official inspections, to maintain health and other records, report illnesses or deaths promptly, and to move members of the flock only according to specifications by the officials for the quarantine period of 24 months. The flock must be inspected semiannually for an additional 18-month period of surveillance and records kept of any animals moved from the flock.

### **Source Flocks**

Source flocks are those determined on ample evidence and after careful consultation to be disseminating scrapie but in which a diagnosis of scrapie has not been confirmed. Flocks from which an affected animal was moved within 18 months prior to showing signs of scrapie should be considered as source flocks. Consideration will also be given to designating a flock as a source flock when a period of more than 18 months is involved and two or more sheep from the flock are found to be affected with scrapie.

Flocks designated as source flocks, and exposed sheep moved from them, shall be given the same study and consideration and handling as applies to infected flocks.

### **Intermediate Source Flocks**

Intermediate source flocks are those through which affected animals have passed enroute from the source to the infected flocks. Such flocks are handled in the same manner as source flocks unless the particular circumstances would indicate otherwise.

These changes in the program provide a way of preserving valuable unaffected bloodlines in the source flocks.

### **Other Exposed Animals**

Heretofore, when exposed animals had been moved from an infected or source flock into another flock, these animals and their first-generation progenies were slaughtered.

If any transferred animals are of the affected bloodline, or if they are not so related but the scrapie outbreak is judged severe, it is still necessary to slaughter those individuals and their first-generation progenies. And other members of the recipient flock must be kept under surveillance for 42 months.

If, on the other hand, the transferred (exposed) animals are not of the affected bloodline, and if the nature of the scrapie outbreak warrants leniency, these animals as well as the remainder of the recipient flock will merely be kept under surveillance for 42 months from the date of the last possible exposure.



## RESEARCH AND COOPERATION

The Agricultural Research Service cooperates with and helps support research at Compton, England, and Edinburgh, Scotland, where scrapie has been studied for many years. Those stations have elaborate facilities for the necessary isolation and observation of animals experimentally affected with scrapie. To duplicate such facilities in the United States would require millions of dollars.

Hundreds of goats and thousands of sheep are used in those experiments. Scientists there have had long experience with the disease and are widely recognized for their competence.

A number of research workers at Federal and State institutions and universities in the United States consider the scrapie virus very useful for medical research purposes and are active in studying this disease.

U. S. disease-control officials cooperate for mutual advantage with Canadian officials, whose eradication program is practically the same as ours.

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